

Applicant : Mihrimah Ozkan et al.  
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Attorney's Docket No.: 15670-036001  
/SD2001-014-2

#### REMARKS

Reconsideration and allowance of the present patent application are respectfully requested.

As an initial matter, the specification has been amended to correct typographical errors. No new matter is added.

Various claims have been amended to clarify their language. Claims 18, 22, 25, and 30-32 have been canceled. New dependent claims 34-39 have been added and are fully supported by the original specification. Hence, upon entry of the amendments, Claims 1-17, 19-21, 23, 24, 26-29, and 33-39 are pending and under examination on their merits. All pending claims should be patentable over the prior art on record for the reasons stated below.

#### Rejections Based on Hang

Claims 1, 2, and 18 stand rejected under 35 USC 102(b) as being anticipated by Hang. This contention, however, is respectfully traversed.

Claims 1, 2 and 18 recite optical tweezers that use one VCSEL, an array of VCSELs, and multiple VCSELs, respectively. The Patent Office cites Column 14, lines 33-38, Column 6, lines 46-49 and 32, and FIGS. 2A and 2B in Hang and contends that the cited portions in Hang show optical tweezers that use at least one VCSEL. In addition, the Patent Office cites Column 6, lines

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56-57 and 32, and FIGS. 2A and 2B to show an array of VCSELs in optical tweezers.

A review of Hang as a whole and the cited portions suggests otherwise. Hang discloses imaging with an array that has spatially interleaved VCSELs 30 and detectors 38 on the same substrate 40. See, Column 6, lines 6-62 and FIGS. 2A and 2B. As illustrated in FIG. 2A, the device in Hang is used as an imaging tool to monitor an object 34. Basically, the VCSELs 30 on the substrate 40 emit light to illuminate the object 34 through an optical system 42 and the detectors 38 on the same substrate 40 collect light from the illuminated object 34, also through the optical system 42. The detector output signals of the detectors 38 form an image of the illuminated object 34.

Therefore, Hang's devices are not optical tweezers but rather optical imaging devices. The VCSELs 30 are simply light sources to provide optical illumination to the object 34. As such, Hang does not teach Claims 1, 2, and 18. The rejections under 35 USC 102(b) are not supported by Hang and thus must be withdrawn.

Admittedly, Hang indeed mentions optical tweezers in Column 14, lines 33-38:

*The commercial potential for a polarized confocal scanning microscope is difficult to predict at this time. For the cell biologist, this will be an enormously welcome tool to study anisotropy in biological material both in fixed*

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as well as living specimens. Since the imaging could be done in "real time" (in at least video rates (30 frames/second) or better), there is the possibility there could be image changes in anisotropy during physiological processes such as signal transduction events, protein-protein interactions, DNA-protein interactions, and the like in living cells. It also can be used to monitor the optical tweezers for measuring the force required to separate antigen-antibody bonds. [Kreistan Helmerson et al., "Optical tweezers-based immunosensor detects femtomolar concentrations of antigens," *Clinical Chemistry* 43:2, pp. 379-383 (1997)].

However, contrary to the contention by the Patent Office, Hang describes applications of Hang's imaging devices in optical tweezers in the above quoted section. In Hang's words, "[i]t also can be used to monitor the optical tweezers for measuring the force required to separate antigen-antibody bonds." Hence, the imaging device shown in FIGS. 2A and 2B in Hang is used to monitor the optical tweezers, e.g., to image particles that are manipulated by optical tweezers.

In view of the above, Hang's imaging device is entirely separate from optical tweezers. In this regard, Hang cites an article by Helmerson et al. to describe the optical tweezers. For convenience of the Examiner, Applicants attach a copy of the Helmerson paper cited by Hang. In the left column on page 380 of the attached Helmerson paper, optical tweezers are described to use a continuous-wave Nd: YAG laser. Therefore, the optical

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tweezers in the Helmersen paper are entirely different from the optical tweezers of the present invention.

The above analysis of Hang and the Helmersen paper cited by Hang suggests that the Office Action is apparently based on an incorrect understanding of the technical features of imaging devices in Hang, and that Claims 1, 2, and 18 are distinctly different from Hang. Therefore, Claims 1, 2, and 18 are patentable over Hang.

**Rejections Based on a Combination of Grier and Hang**

Other claims stand rejected under 35 USC 103(a) over Grier in view of Hang. Again, Applicants respectfully traverse.

Each of the pending claims recites at least one VCSEL as part of an optical tweezer. Grier describes optical tweezers but fails to disclose optical tweezers with VCSELs. As discussed above, Hang fails to disclose optical tweezers with VCSELs. Hence, the combination teaching of Grier and Hang does not disclose optical tweezers with VCSELs. Accordingly, under 35 USC 103(a), the rejections must be withdrawn.

Referring to the original specification of the present application, one or more microbeams derived from a corresponding number of Vertical Cavity Surface Emitting Lasers (VCSELs) are used to manipulate and to transport inorganic and organic objects. An optical tweezer based on the present invention can

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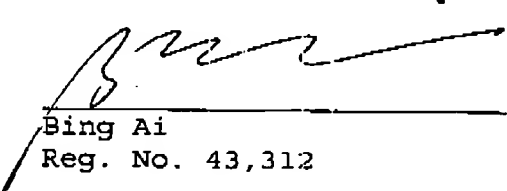
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be made compact in size, and suitable to manipulate multiple objects in an array concurrently, and in parallel. These and other advantages of the present invention are not specifically addressed by the devices in the cited prior art. This further shows that the combinations recited in the claims are not obvious and are patentable.

In summary, all claims should be allowed. Please apply a fee of \$60 for extension of time, and a fee of \$25 for the extra claims, and any other applicable charges or credits, to Deposit Account No. 06-1050.

Respectfully submitted,

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